PATENT ABSTRACTS OF JAPAN

(11)Publication number : **11-250764**
(43)Date of publication of application : **17.09.1999**

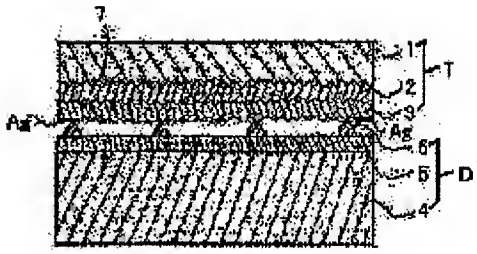
(51)Int.Cl. **H01H 13/70**
G06F 3/033
H01H 11/00
// C08G 77/04
C08G 77/54

(21)Application number : **10-064752**
(22)Date of filing : **27.02.1998**

(71)Applicant : **GUNZE LTD**
(72)Inventor : **NODA KAZUHIRO**
SATOU HIROTOSHI
MURAKAMI YUKIO
TANIMURA KOUTAROU
FURUKAWA SHUJI

(54) RESISTANT FILM TYPE TRANSPARENT TOUCH PANEL

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a resistant film type transparent touch panel with higher transparency, visibility, and abrasion resistance without generating Newton rings.
SOLUTION: This touch panel is provided with a touch side transparent electrode T with a thin-film layer 2 of silicone oxide having a film thickness of 20 to 55 nm interposed as an intermediate layer and display side transparent electrode D so as to be faced with each other through insulating spacers 6. In this case, the surfaces of transparent thin film electrodes 3 and 5 of ITO (indium tin oxide) or the like laminated on the upper surface of the touch side and/or the display side have a rough surface 7, which has uncountable numbers of fine irregularities having center line average roughness (Ra) of 0.05 to 2 μm, and its maximum height (Rmax) of 0.6 t 2.5 μm.



CLAIMS

[Claim(s)]
[Claim 1]A resistance film type transparent touch panel comprising:
The touch side transparent electrode (T) in which a silicon oxide thin film layer (2) of 20-55 nm of thickness and a transparent-thin-film-electrodes layer (3) are laminated one by one by one side of a transparent resin film (1).
The display side transparent electrode (D) in which a transparent-thin-film-electrodes layer (5) is laminated by one side of a transparent plate (4) counters the transparent-thin-film-electrodes layer (3, 5), In a resistance film type transparent touch panel which it comes to arrange via an insulating spacer (6), A split face (7) according [the surface of a transparent-thin-film-electrodes layer (3, 5) by the side of a touch or/and a display] to with arithmetical-mean-deviation-of-profile (Ra)0.05-2micrometer and a maximum height [its] (Rmax) of 0.6-2.5 micrometers countless detailed unevenness.

[Claim 2]The resistance film type transparent touch panel according to claim 1 in which said silicon oxide thin film layer (2) consists of a coating layer by decomposition of perhydropolysilazane, or a sol-gel method of polyfunctional alkoxysilane.
[Claim 3]The resistance film type transparent touch panel according to claim 1 or 2 in which said transparent plate (4) is cyclic polyolefin, a polycarbonate board, or a compound transparent plate with a glass plate.

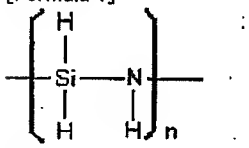
[Translation done.]

DETAILED DESCRIPTION

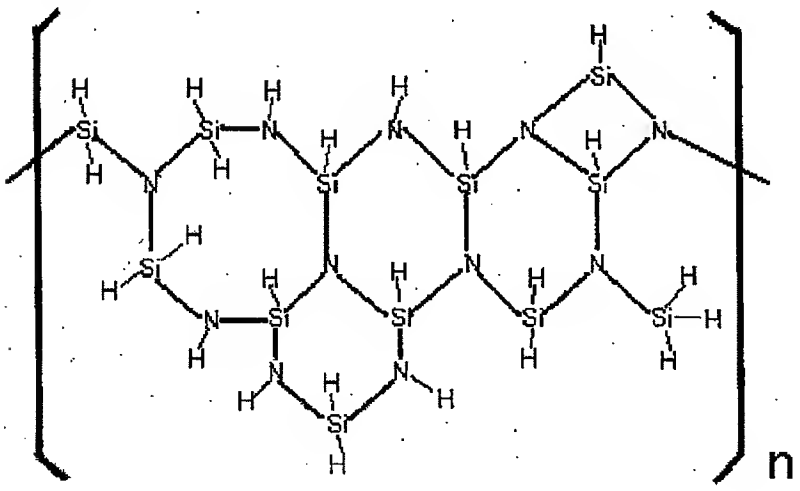
[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention maintains high transparency and visibility and relates to the resistance film type transparent touch panel which Newton rings do not generate with higher abrasion resistance (as opposed to pen sliding) and which was improved highly.
[0002]
[Description of the Prior Art]Generally a resistance film type transparent touch panel (it is only hereafter called a touch panel.), the glass plate which provided transparent electrodes, such as ITO (Indium Tin Oxide), in the display side — and, It is one flat panel device made using the flexible transparent resin film (for example, polyethylene terephthalate film) which provided the thin film transparent electrode in the touch side similarly by carrying out the placed opposite of this electrode surface via an insulating spacer.
This is used combining it with a liquid crystal display, a CRT display, etc.

[0003]By the way, the demand in quality and a performance side also becomes severe with use expansion of a touch panel, and much more improvement of especially transparency, visibility, and abrasion resistance came to be called for. Then, this invention persons find out the new means for solving these technical problems previously, for example, are exhibited by JP,8-64067,A or JP,9-237159,A.
[0004]It is going to attain said each item gazette by carrying out the middle intervention of the silicon oxide layer which specified thickness about the thin film transparent electrode by ITO by the side of the touch which constitutes the conventional touch panel, or a display, etc. That is, in JP,8-64067,A, a 100-600-A silicon oxide thin film layer is first provided on a bright film, Provide an ITO thin film layer on it, and, on the other hand, JP,9-237159,A, As the further improvement of said JP,8-64067,A, the silica dioxide coating thin film layer of 20-55 nm of thickness formed especially of the chemical splitting of perhydropolysilazane is provided, and thin film layers, such as ITO, are provided on it.
[0005]
[Problem(s) to be Solved by the Invention]However, the problem about the Newton rings produced by light interference was newly raised recently, and it needed to solve immediately. When these Newton rings touch the touch side of a touch panel with a pen or a finger and perform information inputting, they are phenomena which a rainbow-colored striped pattern generates in ring shape focusing on that touched point.
[0006]Visibility will get very bad if ** and this occur that it is easy to generate these Newton rings, so that the size of the touch panel itself becomes large. Although visibility means the performance which can carry out input operation of the screen pleasantly legible (without it becomes irritated), it it is generated by Newton rings in the degree of input operation, in order to always go into eyes, input operation becomes impossible pleasantly. If this touch panel is used combining a liquid crystal display, it will also become the rainbow pattern by the color picture and Newton rings from this display overlapping, and also worsening visibility. When performing input operation quickly continuously especially and Newton rings remain, next input operation becomes late or the problem of carrying out an erroneous input will also be generated. That is, the problem of the Newton rings in a touch panel is also a very important solution technical problem in other required improvement in the characteristic.
[0007]This invention finds out and attains the solving means, as a result of standing the transparency improved more, visibility, and also on abrasion resistance, making into a technical problem to develop the touch panel which gave the characteristic which Newton rings do not generate in this and inquiring wholeheartedly. It lectures on the following means.
[0008]
[Means for Solving the Problem]Namely, a resistance film type transparent touch panel this invention is characterized by that comprises the following.
The touch side transparent electrode (T) in which a silicon oxide thin film layer (2) of 20-55 nm of thickness and a transparent-thin-film-electrodes layer (3) are laminated one by one by one side of a transparent resin film (1) so that it may indicate to claim 1 and may clarify.
In a resistance film type touch panel which the display side transparent electrode (D) in which a transparent-thin-film-electrodes layer (5) is laminated by one side of a transparent plate (4) counters the transparent-thin-film-electrodes layer (3, 5), and it comes to arrange via an insulating spacer (6), A split face (7) according [the surface of a transparent-thin-film-electrodes layer (3, 5) by the side of a touch or/and a display] to with arithmetical-mean-deviation-of-profile (Ra)0.05-2micrometer and a maximum height [its] (Rmax) of 0.6-2.5 micrometers countless detailed unevenness.
And in claims 2-3, it provides as an invention with a gestalt desirable as a thing subordinate to claim 1. This invention is explained in full detail below.
[0009]
[Embodiment of the Invention]First, the touch panel (resistance film type transparent touch panel) which will be the requisite for this invention is explained. As shown in drawing 1, as a transparent resin film (1) which is a composition base of the touch side transparent electrode (T) in this touch panel, Generally about 0.1-0.2 mm in thickness and the total light transmittance (it abbreviates to Tt hereafter) are not less than about 80%, and also it excels in heat resistance, flexibility, the solvent-proof characteristic, etc., and the film state thing which is flexible-like and is rich in recovery elasticity is used. The transparent polyethylene terephthalate film by which biaxial stretching was specifically carried out. Begin (to call it a PET film hereafter) and,

otherwise, for example A polyethylenenaphthalate film, A polyether sulfon film, a polycarbonate film, a polyarylate film, a polysulfone film, amorphous polyester film, an amorphous polyolefin film, etc. can be mentioned.
[0010]And 20-55 nm of thickness provides a 30-50-nm silicon oxide thin film layer (2) in one side of said transparent resin film preferably first. By this limited thin film layer being formed, Tt as the whole improves more as compared with the case of only the transparent-thin-film-electrodes layer by ITO etc., and. It will be in the state where it excelled extremely in the abrasion resistance (wear this electrode layer out or prolonged use should not have generating of a crack, either) of this electrode layer touched directly by touch input operation. It will improve more, without losing said characteristic, if said transparent-thin-film-electrodes layer surface in this invention is in a split-face state. That is, the split face (7) in the countless detailed unevenness in the silicon oxide layer of 20-55 nm of thickness and said specific range established in this electrode layer surface mentioned later will be combined unescapable. Even if it is a split face in this specific range of this electrode layer surface, if transparency is bad inferior also to abrasion resistance and exceeds 55 nm, especially at less than 20 nm, it becomes easy to generate a crack, and abrasiveness will reveal the sense of color of not only worsening but light yellow, and, specifically, will serve as a situation which is not preferred to human being's eyes.
[0011]Although the means forming in particular of said silicon oxide thin film layer (2) is not limited, generally Sputtering process, A thin-film-forming means, perhydropolysilazane, or polyfunctional alkoxysilane, such as a vacuum deposition method and a CVD method, can be used as a raw material, and the coating method formed by these coating can be illustrated.
[0012]In said sputtering process, one side of transparent resin films, such as said PET film generally performed preferably first, for example, degreasing washing and a corona, After performing discharge by glow etc. as pretreatment, it confronts each other in the vacuum chamber of a sputtering system, and silicon and this film which added the silica dioxide and the conductive impurity as a target are set. And by mixing oxygen in inactive gas or this gas, such as argon, and introducing in this tub, the degree of vacuum in this tub is kept at about 10-1 to 10 to 3 Torr. And it is the method of carrying out weld slag vacuum evaporation and forming a 20-55-nm thin film with high frequency or a direct-current magnetron method.
[0013]On the other hand, the silicon oxide thin film layer by the perhydropolysilazane illustrated as a coating method, first — one side of said transparent resin film — the organic solvent solution (for example, xylene.) of this polysilazane The solution which made solids concentration several percent by using aliphatic series ether, such as aromatic compounds, such as decahydronaphthalene, and dibutyl ether, etc. as a solvent is coated by methods, such as spin coating, dip coating, spray coating, and roll coating. Next, fatty amine (for example, triethylamine) is steam-ized for this this coated polysilazane side, and it is neglected under the mixed vapor atmosphere which mixed this and a steam. If it is finally neglected for several minutes under the high-humidity/temperature atmosphere before and behind around 100 ** and 80% of relative humidity, it will decompose chemically, and this polysilazane will change to a silica dioxide, and will be formed by 20-55-nm thickness. Since it is also possible to add as a decomposition accelerator in the decomposing means to the silica dioxide of this this polysilazane, and to heat sodium alcoholate and an acetylacetonato complex (for example, palladium complex) in humidity otherwise to it, for example, it is not limited to that method in particular.
[0014]Said polysilazane is marketed as a cold cure type polysilazane solution (for example, N-V110), for example from TONEN CORP. Although this chemical structure is fundamentally shown by the following-ization 1 (n is a degree of polymerization), the thing of the irregular cyclic structure shown in the following-ization 2 may live together.
[0015]
[Formula 1]



[0016]
[Formula 2]



[0017]Since solubility's [as opposed to / that it is the amount of polymers too much / an organic solvent] falling and the labile to a silicon dioxide also fall, the molecular weight of said polysilazane is not desirable. A desirable molecular weight is about 600-

2,000, and it is preferred that it is a polymer of the grade called oligomer. In ** 1 or ** 2, coexistence of some of the polyorgano silazane by which the hydrogen atom was replaced by the alkyl group, for example is substantially excepted, even though it is allowed. This is because it is not effective for the more homogeneous silicon dioxide coating stratification. This polysilazane pours ammonia into the complex of dichlorosilane and pyridine, and can compound it by performing an ammonolysis, for example.
[0018]Next, coating by a sol-gel method by polyfunctional alkoxysilane is explained. First, this alkoxysilane is a silane compound which combines 2-4 of an alkoxy group, Dimethoxy dimethylsilane, trimethoxy methylsilane, a tetramethoxy silane, diethoxy diethylsilane, a trimethoxy ethylsilane, a tetraethoxysilane, etc. are mentioned concretely. Since alkoxysilane which combines 3-4 alkoxy groups especially can perform change to a silica dioxide efficiently, it is desirable.
[0019]And said polyfunctional alkoxysilane is mixed with water and alcohols into mixed liquor of catalysts (chloride etc.). Although the mixture ratio of each ingredient is decided in quest of an optimum value by preliminary experiment, if an example is given, it will be a rate of 2 mol of water, 6 mol of alcohols (mainly ethyl alcohol), and 0.03 mol of chloride to this 1 mol of alkoxysilane. obtained sol — a transparent resin film is coated with -**** liquid with a coating method illustrated to said perhydropolysilazane carried out. If coating is completed, it is neglected at ordinary temperature, and beforehand, evaporative removal of the solvent will be carried out and, finally it will be heated with prescribed temperature (generally around 100 **). It decomposes and this alkoxysilane layer currently coated changes to a silica dioxide. said sol — -**** liquid is marketed as col coat N-103X, for example from col coat incorporated company.
[0020]As mentioned above, although illustrated about means forming of a silicon oxide thin film layer of 20-55 nm of thickness, formation by a coating method of the two latters is especially preferred. In leading to a fall of visibility, and surface roughening by detailed unevenness mentioned later, this is obtained, and it is hard and it is hard for it to be easy to color it light yellow, and to control it by thin-film-forming means, such as sputtering, as arithmetical mean deviation of profile and its maximum height want. On the other hand, in a latter two-way-type method, it is obtained as it is completely water-white, it is easy to recognize visually and arithmetical mean deviation of profile and its maximum height want in this surface roughening, and it is because it is easy to control.
[0021]It is considered to originate in a stoichiometrical gap from a silica dioxide of silicon oxide by which formation ** is carried out that said sense of color differs. That is, in thin-film-forming methods, such as sputtering, silicon oxide formed is in a state where it is shown by SiOx (x= 1-1.9), and SiO, Si2O3, etc. live together. By these coexistence, while a refractive index becomes high rather than a silica dioxide, optical absorption in a light range arises. However, since a silicon oxide layer which consists of coating of perhydropolysilazane or polyfunctional alkoxysilane is close to a pure silica dioxide, a refractive index is also small and optical absorption does not produce it, either.
[0022]Although said silicon oxide layer presupposes at the touch side transparent resin film that it is indispensable, it may be formed in a transparent plate (4) by the side of a display like the above. of course, both sides of these each substrate — the same — ****** — there is no restriction in things.
[0023]Next, a transparent-thin-film-electrodes layer (3, 5) which is laminated on a silicon oxide layer of 20-55 nm of thickness in the touch side, and is laminated on one side of a transparent plate (4) in the display side is explained.
[0024]Although a formation material of said both transparent-thin-film-electrodes layer (3, 5) is generally represented by ITO (indium oxide tin which doped tin to indium oxide) in common, Tin oxide antimony (ATO) which otherwise doped a tin dioxide with antimony or fluoride, for example, Or since metallic oxides etc. which are not doped, such as doping metal oxides, such as zinc oxide aluminum (AZO) which doped tin oxide fluoride (FTO) and a zinc oxide with aluminum, and a multiple oxide of indium oxide and a zinc oxide, may be sufficient, there is no restriction in particular. It is good in these illustration also as this electrode layer from which both construction material differs.
[0025]And said transparent-thin-film-electrodes layer Although means forming is based on a method of of ion plating sputtering process generally performed, a vacuum deposition method, a CVD method, or the method etc., sputtering process is preferably used also in respect of quickness also in operating condition. This sputtering process targets a sintered compact of metallic oxides, such as said ITO, for example, confronts each other in a vacuum chamber of a sputtering system, and sets said body. And by mixing oxygen in inactive gas or this gas, such as argon, and introducing in this tub, a degree of vacuum in this tub is kept at about 10-1 to 10 to 3 Torr. And it is the method of carrying out weld slag vacuum evaporation and forming a transparent electrode thin film of predetermined thickness with high frequency or a direct-current magnetron method.
[0026]Although thickness of said transparent-thin-film-electrodes layer is not limited, it is desirable to be referred to as 10-40 nm. This is because it is the most effective from processability for conductivity (generally 200-1Kohm/sq.) required as a touch panel, transparency, abrasiveness, and surface surface roughening by detailed unevenness mentioned later, etc.
[0027]since a transparent plate (4) by the side of said display also needs not to curve or become depressed to touch press from the touch side transparent electrode — ** — although a direct transparent plate is used and the thickness is based on material, generally it is about 0.5-2 mm. However, from a point of transparency, the thinner possible one is desirable. As a material, although an inorganic glass board is generally used, transposing this to a plastic sheet these days is also performed from a point of handling nature and a weight saving. if it is necessary to also take into consideration and decide heat resistance, chemical resistance, and mechanical properties but in the case of this plastic sheet, and it illustrates — that of the following — although -- it is mentioned. For example, cyclic polyolefin, polycarbonate, diethylene-glycol bisallyl carbonate, A copolymer of polymethylmethacrylate, polystyrene, and a methylmetaacrylate and styrene, It is a plate by a copolymer of styrene and acrylic nitril, polyether sulphone, polysulfone, poly (4-methylpentene- 1), polyarylate, amorphous polyester (generally called A-PET), etc.
[0028]In the case of said plastic sheet, a polycarbonate board is used, but it remains for using it, carrying out use limitation moreover with small size. This reason twists a polycarbonate board for not being the material it can be satisfied with vacuum film formation, such as sputtering, of material enough from reasons absorptivity's being large and heat-resistant temperature are low etc., as compared with other resin etc., although excelled in shock resistance. Especially a means solvable to these problems is using a compound transparent plate with cyclic polyolefin. Other transparent plates compounded with cyclic polyolefin here begin an inorganic glass board, Although it may be any of said plastic sheet to illustrate, composite with an inorganic glass board from a point or a polycarbonate board which the characteristics, such as dimensional stability required as a touch panel, can reveal on a synthetic more high level is desirable.
[0029]Cyclic olefin became the main ingredients, it is the polymer combined in a main chain, and the crystallinity of a polymer by straight chain olefin was changed to amorphism nature, and higher transparency, low birefringence, heat resistance, chemical resistance, etc. were given, and cyclic polyolefin says what [all] is generally known. Although it is norbornene which this polymer is well known as cyclic olefin, and is used, It is represented by two of copolymerization cyclic polyolefin by addition condensation of independent cyclic polyolefin obtained by carrying out hydrogenation, and norbornene and straight chain olefins, such as

ethylene, after carrying out ring opening polymerization of this norbornene itself. There are "ARTON" (trademark) currently marketed from Japan Synthetic Rubber Co., Ltd. by what known as independent cyclic polyolefin, and "ZEONEX" (trademark) currently marketed from Nippon Zeon Co., Ltd., As a copolymerization cyclic polyolefin polymer, "Appel" (trademark) currently marketed from Mitsui Chemicals, Inc. has..

[0030]In said composite, cyclic polyolefin is good to compound by thickness thinner than a board to be compounded. This is because it can leave the effective characteristic of a compounding board itself and the characteristic of this polyolefine can be made to multiply. The thickness is good to be referred to as about 0.05-0.3 mm, and to adjust overall thickness to 0.5-2 mm. And the compound method is performed by a method whether adhesion composite of this annular polyolefin film with a thickness of 0.1-0.4 mm generally obtained by forming separately is carried out via transparent adhesives, or for this to be coated, and to dry and compound using an organic solvent solution of this polyolefine.

[0031]And although composite is performed on one side of a near board with which a transparent-thin-film-electrodes layer (5) is laminated at least to be compounded of course, it may go to both sides. Since a board to be compounded can be made thinner when both sides are compounded, it is lighter-weight, and since a compound transparent plate which is excellent in dimensional stability etc. is obtained, it is desirable.

[0032]Although formation of a transparent-thin-film-electrodes layer by ITO in the case of said compound transparent plate, etc. is performed on conditions like the above, When carrying out adhesion composite using an annular polyolefin film formed beforehand, it is good to form this transparent-thin-film-electrodes layer in a stage of this film, and for a means to carry out adhesion composite to perform this to a board to be compounded. Since impurity gas, such as water and a remains organic solvent, is emitted in large quantities from this board when carrying out sputtering after a compound board is formed, this, It is because the sputtering itself serves as a batch production and it cannot produce [that membraneous quality of transparent-thin-film-electrodes layers, such as ITO for which it asks as a result, is not obtained, or] continuously to others. To cyclic polyolefin, I hear that the reason for having explained as the above and polycarbonate board independent fault which cannot give higher conductivity cannot perform sputtering, such as ITO in a temperature low heat deflection temperature of polycarbonate and higher, and there is.

[0033]Although said transparent-thin-film-electrodes layer has three electrode patterns according to information inputting form of a touch panel, it is all applicable in this invention. One of the electrode pattern of this is the surface state pattern in which the touch and display side is also provided in the whole surface, An analog form which consists of this, a matrix system which another intersects in this with stripe shaped patterns, and the 3rd are a surface state pattern and stripe shaped patterns, and they are a mixed method which consists of this.

[0034]And in between the touch side transparent electrode (T) and the display side transparent electrodes (D) generally [an insulating spacer], It is provided for switch ON/OFF operation by touch, and, generally may be carried out about the producing method, size, a locating position, and quantity, and there are no conditions in particular that are regulated. However, it must be an insulator higher than the maximum height (Rmax) of 0.6-2.5 micrometers of detailed unevenness in surface roughening formed in a transparent-thin-film-electrodes layer mentioned later about a size of this spacer, especially height. Others should just maintain necessary minimum conditions so that switching operation may be performed smoothly. If shown in illustration, on a transparent-thin-film-electrodes layer provided in the display side, it will have a crawler bearing area of 0.001-0.003 mm2, 4-10 micrometers in height, a 3-5-mm-pitch size, and an interval, and will implant by print processes, such as screen-stencil, using acrylic transparent hardening resin.

[0035]In a resistance film type transparent touch panel explained as mentioned above, by this invention, further, The surface of a transparent-thin-film-electrodes layer (3, 5) especially established in the upper layer by the side of a touch or/and a display is not smooth, and 0.05-2 micrometers of arithmetical mean deviation of profile (it abbreviates to Ra below), It needs things that 0.07-1.5 micrometers and the maximum height (it omits the following Rmax) of those have preferably 0.6-2.5 micrometers of split faces of countless detailed unevenness which is 1-2 micrometers preferably. This is explained below.

[0036]First, by being a split face in the range, the transparency of a resistance film type transparent touch panel which will be the requisite in this invention at least which it originally has can also maintain visibility and abrasion resistance, and can solve at once a fault of Newton rings by which it was newly generated. And visibility and abrasion resistance can also be further raised now with this surface roughening. These effects are things of the above [the split face] obtained only after are especially in the range of Ra and Rmax. That is, since it is a detailed unevenness split face too much in less than 0.05 micrometer in Ra, wear-resistant improvement is also no longer found as well as it becoming impossible to prevent generating of Newton rings thoroughly. When it exceeds 2 micrometers, on the whole, it is recognized visually whitely, therefore it becomes impossible on the other hand, to maintain transparency.

[0037]On the other hand, about Rmax, in said Ra, height of the unevenness is specified as further 0.6-2.5 micrometers, and even if it is [therefore] Ra=0.05-2micrometer, it will mean that it must be less than the range of Rmax=0.6-2.5micrometer, and there will be. Since the surface of a transparent-thin-film-electrodes layer will turn into a more detailed mat state side if smaller than 0.6 micrometer, it becomes impossible that is, for generating of Newton rings to prevent thoroughly. Conversely, if it exceeds 2.5 micrometers, it will be in a surface state which higher unevenness towers and exists all over a Ra=2micrometer split face, and scattered reflection of the light will be carried out and it will worsen visibility. Since it may be equivalent to height of an insulating spacer or may become more than it, a transparent-thin-film-electrodes layer by the side of a touch and a display touches very easily, or will not be in the state where it has always touched, does not achieve a function of an insulating spacer, and cannot use it as a touch panel.

[0038]Although the aforementioned split face is generally established in the surface of a transparent-thin-film-electrodes layer (3) by the side of a touch, it may provide this in the surface of a transparent-thin-film-electrodes layer (5) by the side of a display, or this surface of these both sides.

[0039]And said Ra=0.05-2micrometer, Rmax = although the following three can be illustrated about a means to provide countless detailed unevenness of 0.6-2.5 micrometers, it is not specified as these.

[0040]Embossing of the one method is first carried out to a transparent resin film by the side of a touch used as a base, or the transparent plate (in case of plastic) whole surface by the side of a display using a metallic roll by which embossing was carried out, and size enlargement is carried out to a split face considered as a request. Although size enlargement of the split face of a crevice processed on a metallic roll side here is carried out to this film or a plastic sheet side, generally it does not reappear as it is and size enlargement of it is carried out to it being also at a certain rate in a smaller split face in many cases. Therefore, Ra=0.05-2micrometer, Rmax to need = although it will decide by conducting preliminary experiment, whether it is good to produce a crevice of a size of which to a metallic roll side to 0.6-2.5 micrometers, Surface roughness of a metallic roll side should just aim

at profile Ra=0.5-4micrometer and Rmax=5-20micrometer.
[0041]Although said embossing metallic roll is generally produced by machinery, laser engraving or phototype process, and a chemical etching method, generally the embossing conditions by this are as follows. Stand face to face against this metallic roll, win popularity, form a roll, and during this period Linear pressure about ten to 50 kg/cm, Rolling press working of sheet metal is carried out through a transparent resin film or a plastic sheet under a heating condition set up low 20-30 ** from softening temperature of the rolling speed 2 - 10 m/min, a transparent resin film, or a plastic sheet.
[0042]The second method is methods by coating. Generally this carries out dispersion mixing of the silica transparent pulverized coal to transparent resin (there are many cases of acrylic resin), and coats the whole surface of said transparent resin film or a transparent plate (an inorganic glass board or a plastic sheet) with this. By silica pulverized coal to distribute, a split face of Ra and Rmax for which it asks is acquired. Since Ra and Rmax can control the range with a size of this pulverized coal, and quantity mixed to this transparent resin, an optimal condition will be decided by preliminary experiment. When a compound board with said cyclic polyolefin performs this coating, it is good to perform this coating on a film of cyclic polyolefin, and to take a method of pasting this together with adhesives etc. to a transparent plate first.
[0043]Using a transparent substrate by the side of a touch by which split-face grant was carried out beforehand, or a display, by a means to describe above to this, a method of illustrating above laminates a 20-55-nm silicon oxide thin film layer and a transparent-thin-film-electrodes layer one by one in the touch side, and laminates a transparent-thin-film-electrodes layer by the display side. Countless detailed unevenness of Ra=0.05-2micrometer and Rmax=0.6-2.5micrometer will be given to the surface of each transparent-thin-film-electrodes layer of the upper layer obtained as a result.
[0044]Unlike the above, the third method disburses an embossing metallic roll described above to a transparent-thin-film-electrodes stratification plane by the side of a touch which might be laminated by the means, or a display, and carries out a rolling press directly, Size enlargement of the countless detailed unevenness of Ra=0.05-2micrometer and Rmax=0.6-2.5micrometer is carried out to this electrode layer surface. Although there is no difference as substantially as a case where size enlargement of the embossing conditions here etc. is carried out to the aforementioned transparent substrate, since a crack may arise in a lower layer silicon oxide layer when carrying out size enlargement to a transparent-thin-film-electrodes stratification plane by the side of a touch especially, it fully needs to be careful. It is good to take a method of carrying out embossing to a transparent electrode layer by the side of a display, and making it into a desired split face from this point, when based on these 3rd method.
[0045]Methods that it is desirable in a production means of a resistance film type transparent touch panel by this invention explained above are the following two cases.
[0046]First, one of them carries out [aforementioned] embossing of the whole surface of a transparent resin film by the side of a touch, forming a predetermined split face — a perhydropolysilazane solution of the above [split face / the] next, or sol of polyfunctional alkoxysilane — -**** liquid, [coat and] Decompose into a silica dioxide respectively and a 20-55-nm silicon dioxide layer is formed, Ra=0.05-2micrometer, Rmax which were obtained by finally laminating transparent-thin-film-electrodes layers, such as ITO, by sputtering = The touch side transparent electrode which consists of a 0.6-2.5-micrometer split face, It is obtained via an insulating spacer implanted in this display side transparent-thin-film-electrodes layer by carrying out the placed opposite of the display side transparent electrode which provided a transparent-thin-film-electrodes layer in a plate surface of an inorganic glass board or a plastic by ITO by sputtering, etc. About formation of the aforementioned silicon oxide thin film layer. sol of a perhydropolysilazane solution or polyfunctional alkoxysilane — a coating method with -**** liquid, What is more desirable than formation by weld slag vacuum evaporation of silicon which added a conductive impurity of further others depending on a silica dioxide or the case, Ra=0.05-2micrometer, Rmax which are given for Newton-rings prevention in addition to the manifestation effect of the sense of color and higher transparency = it is because it is easy to control although a 0.6-2.5-micrometer split face is formed. That is, since a concave portion will be thickly coated in a coating method rather than a convex portion of an uneven part and it is buried with it even if there is a substandard concave portion (Rmax is influenced), Ra and Rmax which were obtained go into a mentioned range easily.
[0047]another -- one side of a transparent resin film by the side of a touch — sol of said perhydropolysilazane solution carried out or polyfunctional alkoxysilane — -**** liquid being coated, and it decomposing chemically and, The touch side transparent electrode which formed a 20-55-nm silicon oxide thin film layer, carried out weld slag vacuum evaporation of the ITO etc. on it, and laminated and obtained a transparent-thin-film-electrodes layer, Surface roughening of the transparent resin containing said embossing or silica pulverized coal is coated and carried out to one side of an annular polyolefin film, Ra which carried out weld slag vacuum evaporation of the ITO etc. on it, and laminated and obtained a transparent-thin-film-electrodes layer = 0.05-2 micrometers, Rmax = it is obtained via an insulating spacer implanted in this display side transparent electrode side by carrying out the placed opposite of the compound transparent plate which obtained the display side [0.6-2.5 micrometers] transparent electrode by pasting it together to a plastic sheet or an inorganic glass board.
[0048]
[Example]Hereafter, this invention is further explained in full detail according to an example with a comparative example. Ra as used in the field of in the text or this example, Rmax, transparency, abrasion resistance, and Newton rings are measured as follows, and this expresses them.
[0049]O Ra and Rmax ... It is the value measured with the surface-roughness-shape-measurement machine" surfboard COM 570A" type by Tokyo Seimitsu Co., Ltd.
[0050]O Transparency ... Total-light-transmittance [%] Tt shows, and this shows transmission quantity with a wavelength of 300-800 nm measured with the U-3410 type spectrophotometer by Hitachi, Ltd. based on JIS K7105 (1981) about each sample by %. Transparency will be high, so that this is large.
[0051]O Abrasion resistance ... Using the touch panel produced in each example, a load (250g or 500 g) is performed to the nib (R= 0.8 mm) made from polyacetal, and both-way sliding of the homotopic by the side of a touch is carried out. Sliding distance is 50 mm, is counted with one one way and performs this five to 100,000 to 200,000 times. And when becoming prescribed frequency, by the following method, potential difference deltaV generated in the sliding part is measured, and it ** with impressed electromotive force (5V), and is shown by % as endurance. It will excel in abrasion resistance, so that this value is small. The measuring method of potential difference deltaV is as follows. First, if it slides on prescribed frequency, the transparent electrode by the side of a touch will be removed, and this will be set to the measuring circuit shown in drawing 2. And the voltage of 5V is impressed to silver paste electrode Ag of both ends. And the value of the potentiometer Vc is recorded at right angles to the orbit 10 of pen sliding by the probe 9 provided very in + the measuring circuit 8 side, carrying out the sensing pin of the transparent-thin-film-electrodes layer surface at intervals of 1 mm. Since big potential difference deltaV will occur in a sliding

portion when the transparent-thin-film-electrodes layer laminated is greatly worn out or a crack etc. enter by pen sliding, it will separate greatly from an ideal voltage gradient curve in case there is not wear or a crack.
[0052]O Newton rings ... The touch surface of the touch panel produced in each example is touched 30 points in pinpoint at random with the nib (R= 0.8 mm) made from polyacetal. It is checked by viewing whether a rainbow-colored interference fringe occurs around a touched point.
[0053](Example 1) Embossing of one side of 188 micrometers in thickness and 350 mm in width a biaxial-stretching PET film roll (Tt = 88.8%) was carried out first on the following conditions.
O Embossing metallic roll ... By laser engraving, Ra=1.9micrometer, Rmax = surface chrome plating roll O pressing pressure made into a 18.4-micrometer split face (linear pressure) ... 35kg[/cm] O press temperature (skin temperature of a metallic roll) ... the surface roughness of the PET film side in which size enlargement was carried out by 175 ** O **********3 or more m/min, Ra=0.14micrometer, Rmax = it was 1.18 micrometers.
[0054]Next, carry out roll coating of the m-xylene solution which dissolved 5% of the weight of perhydropolysilazane to the split face of said obtained embossing PET film, and evaporative removal only of the m-xylene is carried out to it, After making the steam which contains a triethylamine steam after that contact, 5min neglect was carried out under 95 ** and RH85% atmosphere at the last. When the acquired coating layer side was checked by XPS (X-ray Photospectroscopy), it checked that it was a nearly perfect silica dioxide film. And the thickness of the silica dioxide thin film was about 50 nm in average thickness. Tt=89.5%, Ra=0.11micrometer, Rmax = at 0.94 micrometer, as compared with coating before, nebula decreased considerably and the transparent feeling increased.
[0055]Next, said obtained PET film was cut out to 120 x 100 mm, all over the silica dioxide thin film layer on this film, sputtering of the ITO was carried out on the following conditions, and the transparent-thin-film-electrodes layer was laminated.
O A weld slag method ... a direct-current magnetron O target ... the sintered compact O film temperature of ITO (indium tin oxide) ... a 100 **O degree of vacuum ... 2x10-3Torr (gas which mixed oxygen 4.5% to Ar)
O Supplied power ... 0.8 kWO membrane formation time ... The thickness of the ITO electrode thin film layer laminated 5 sec was 25 nm. Tt=88.1%, Ra=0.11micrometer, Rmax = it was 0.94 micrometer. Hereafter, the film which laminated and obtained the thin film is called a touch side PET transparent electrode.
[0056]On the other hand, the inorganic glass board (Tt = 91.6%) of 1.1 mm in thickness and 120 x 100 mm was prepared, sputtering of the ITO was carried out to this whole surface on said same conditions, and the transparent-thin-film-electrodes layer of ITO was laminated. The laminated ITO thin film electrode layer thickness was 26 nm, and it was smooth in the surface with Tt=91.0%. This is called below the display side glass transparent electrode.
[0057]Next, the extraction electrode (5 mm in width and about 10 micrometers in thickness) was formed in both the sides of the longitudinal direction of said touch side PET transparent electrode by screen-stencil of silver conductive paste. On the other hand, to said display side glass transparent electrode, UV irradiation of the photo-curing type acrylic resin was screen-stenciled and carried out, and it was hardened so that a dot spacer 7 micrometers in height and 50 micrometers in diameter might be alternately implanted in a 3-mm pitch. At the end, the obtained two electrodes were assembled as a touch panel face to face.
[0058]About said touch panel assembled and obtained, first, after checking the existence of generating of Newton rings, abrasion resistance (pen sliding durability) and sense of color were investigated. The result was summarized in Table 1.
[0059]
[Table 1]

実施例、比較例		ニュートンリング発生の有無	耐摩耗性(ペン耐久性%)			色感や透明感
			5万	10万	20万	
実施例1		発生せず	0.05	0.11	0.15	白濁感なく、透明感も良好
実施例2		同上	0.06	0.12	0.19	同上
比較例1	タッチパネル15	同上	0.35	0.70	1.51	若干の白濁と黄色みがある
	タッチパネル70	同上	0.04	0.11	0.16	白濁感はないが黄色みを感じる
比較例2	タッチパネルA	わずかに発生	0.30	0.57	0.99	透明感が良好
	タッチパネルB	発生しないが、凹凸が目に入る	0.05	0.13	0.18	凹凸による散乱光が目に入る
比較例3		発生	0.18	0.36	0.71	透明感が良好
比較例4		発生	0.44	0.95	2.03	黄色みが強い

[0060](Example 2) Pretreatment by corona discharge treatment was first performed on this one side using the same PET film as having used in Example 1. To this treated surface, to 1 mol of tetraethoxysilanes And 6 mol of water, the sol which mixed the whole as became a rate of 6 mol of ethyl alcohol, and 0.03 mol of chloride — after carrying out roll coating of the -**** solution and carrying out evaporative removal of the solvent by 70 ** and the hot air drying of 30 sec, it heated for 5 minutes at 1.5hr and also 120 ** at 100 **. When the obtained coating layer was checked by XPS, it has checked that it was a perfect silica dioxide film. Thickness is 47 nm and there was 89.8% of Tt.
[0061]Next, on said obtained silica dioxide thin film, sputtering of the ITO was carried out on the same conditions as having carried out in Example 1, and the ITO transparent-thin-film-electrodes layer of 24 nm of thickness was laminated on the whole surface. At this time, Tt was 88.3%. What was obtained here is called a touch side non-split-face PET electrode.
[0062]on the other hand — an annular polyolefin film (ARTON by Japan Synthetic Rubber Co., Ltd..) 0.1 mm in thickness, and 750 mm in width Tt = on 92.5% of one side. Silica pulverized coal with a particle diameter of 5 micrometers. The organic solvent

(methyl-ethyl-ketone / ethyl acetate / three ingredients of isopropyl alcohol mixed solvent) solution which uses as the main ingredients the photoresist acrylic system monomer thru/or oligomer which made with 4 % of the weight and a particle diameter of 3 micrometers silica pulverized coal contain 2% of the weight is coated with a roll coater, After carrying out evaporative removal of this solvent, ultraviolet rays were made to irradiate with and harden. The thickness of this obtained hardening layer was 4 micrometers, and the split face was Ra=0.14micrometer, Rmax=1.46micrometer, and Tt=92.0%.
[0063]Next, except film temperature being 130 **, on the same conditions, as the PET film of Example 1 performed, sputtering of the ITO was carried out and the transparent-thin-film-electrodes layer of ITO was provided in the whole surface. The thickness of the electrode layer of this ITO was 30 nm, and the split face was Ra=0.14micrometer and Rmax=1.46micrometer, and was Tt=89.5%.
[0064]On the other hand, the obtained above-mentioned film was pasted up on the polycarbonate board (Tt = 90.0%) 1.0 mm in thickness, and 120 mm long [100 mm wide and] via the acrylic pressure sensitive adhesive (NITTO DENKO CORP. make HJ-9150W), and the compound transparent plate was produced. Tt of the obtained transparent plate = it was 88.0%. This board obtained here is called the display side split-face compound board electrode.
[0065]And so that it may be set to 5 mm in width, and 10 micrometers in thickness at both the sides of the longitudinal direction of said touch side non-split-face PET electrode, The extraction electrode by silver conductive paste was provided like Example 1, on the other hand, the same insulating spacer was implanted in said display side split-face compound board electrode like Example 1, it was countered in both electrode surface, and the touch panel was assembled to it.
[0066]It investigated about Newton rings, abrasion resistance, and sense of color like [touch panel / said / which was obtained] Example 1, and the result was summarized in Table 1.
[0067](Comparative example 1) (when the thickness of a silicon oxide thin film layer is outside the range)
In Example 1, on the whole surface of the surface roughening PET film by embossing of two sheets similarly obtained on conditions. Except making what changed the thickness of the silica dioxide thin film layer by perhydropolysilazane into 15 nm and 70 nm, and laminated it respectively, the transparent electrode by the side of a touch and a display was respectively produced on the same conditions, and it finished setting up on 2 sets of touch panels similarly hereafter. The touch panel by this 15nm silica dioxide thickness is called the touch panel 15, and the touch panel by 70 nm is similarly called the touch panel 70. Newton rings, abrasion resistance, and sense of color were measured about each, and it collected into Table 1. After laminating a 15-nm silica dioxide thin film, the split faces of a PET film are Ra=0.13micrometer and Rmax=1.10.
In 70-nm lamination, they were Ra=0.06micrometer and Rmax=0.75micrometer similarly.

[0068](Comparative example 2) (when the split faces Ra and Rmax are outside the range)
In Example 1, in the embossing conditions performed to a PET film, Except using this roll of two that changed the split face of the chrome plating metallic roll into Ra=0.75micrometer, Rmax=12.5micrometer (it is called the comparison roll A below), and Ra=1.45 and Rmax=25.3micrometer (it is called the comparison roll B below), Embossing was carried out on the same conditions and a 50 nm silicon oxide layer and a 25-nm ITO electrode thin film layer were laminated one by one like Example 1 using the PET film which has two kinds of this detailed unevenness henceforth.
[0069]The surface roughness of the ITO electrode thin film layer side in the case of being based on said comparison roll A was Ra=0.03micrometer and Rmax=0.95micrometer, and was Tt=88.7%. On the other hand, the surface roughness of the ITO electrode thin film layer side in the case of being based on the comparison roll B was Ra=1.45micrometer and Rmax=4.5micrometer, and was Tt=88.3%.
[0070]On the other hand, the transparent electrode by the side of a display provided and produced the ITO thin film electrode layer of 25 nm of thickness on the whole surface of two inorganic glass boards on the same conditions as Example 1.
[0071]And the extraction electrode and insulating spacer by silver conductive paste were implanted in each transparent electrode by the side of the aforementioned touch and a display like Example 1, the both electrode surface was assembled face to face, and 2 sets of touch panels were obtained.
[0072]It measured [each] about Newton rings, abrasion resistance, and sense of color by having used the thing based on the touch panel A and the comparison roll B for the thing based on the comparison roll A as the touch panel B, and collected into Table 1.
[0073](Comparative example 3) (when a split face was not used but it is made a smooth side)
In Example 1, embossing was not carried out to a PET film, but others laminated the silica dioxide thin film layer and ITO transparent-thin-film-electrodes layer by pel hydroxy polysilazane one by one on the same conditions, and produced the touch side transparent electrode. 50 nm and the ITO transparent-thin-film-electrodes layer of this silica dioxide thin film layer laminated here were 25 nm, and Tt was 90.2%.
[0074]And the transparent electrode by the side of a display was produced like Example 1, countered with the aforementioned touch side transparent electrode, and it finished setting it up on the touch panel. Newton rings and abrasion resistance were measured about this touch panel, and it collected into Table 1.
[0075](Comparative example 4) (when not carrying out the middle intervention of the silicon oxide thin film layer)
Except [all] not providing the silica dioxide thin film layer by the pel hydroxy polysilazane laminated to the PET film by the side of a touch in Example 1, on the same conditions. The ITO transparent electrode by the side of a touch and the display side glass transparent electrode which opposes this were produced respectively, and it finished setting up on the touch panel similarly hereafter. Newton rings and abrasion resistance were measured and this touch panel was summarized into Table 1. The surface roughness of the touch side ITO thin film electrode layer surface was Ra=0.02micrometer and Rmax=0.34micrometer, and was Tt=87.3%. From this, it is shown from the case of only an ITO transparent-thin-film-electrodes layer by 20-55 nm of silica dioxide thin film layers being laminated that transparency improves.
[0076]
[Effect of the Invention]It comprises this invention as aforementioned.
Therefore, the following effects are done so.

[0077]First, the transparency of the whole touch panel improves more because a silicon oxide thin film layer carries out a middle intervention by 20-55 nm of thickness.
[0078]It is not generated at all by Newton rings at the time of a touch. As a result, a screen is legible, and since a character etc. can be read correctly in a short time, input operation of information can be performed lightly. Since the color tone of a display is recognized visually as it is, mentally, I am not irritated.

[0079]Abrasion resistance (wear of transparent-thin-film-electrodes layers, such as ITO generated especially by pen input operation, and generating of a crack) is improved greatly.
[0080]Since it had the sense of color near colorlessness in the whole, the clearer and legible touch panel could be obtained.

[Translation done.]

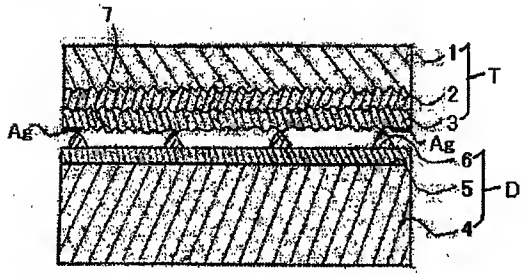
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a figure showing the sectional view of the touch panel in this invention.
[Drawing 2]It is a measuring circuit figure for a wear-resistant check.
[Description of Notations]
1. Transparent resin film
2. Silicon oxide thin film layer
3. Transparent-thin-film-electrodes layer
4. Transparent plate
5. Transparent-thin-film-electrodes layer
6. Insulating spacer
7. Split face by countless detailed unevenness
8. Measuring circuit
9. Probe
10. Pen sliding orbit
T. Touch side transparent electrode
D. Display side transparent electrode
Ag. silver paste electrode

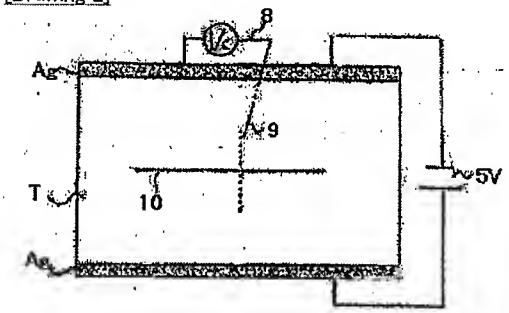
[Translation done.]

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号

特開平11－250764

(43)公開日　平成11年(1999)９月17日

(51)Int.Cl.[6]	識別記号	ＦＩ	
Ｈ０１Ｈ　13/70		Ｈ０１Ｈ　13/70	Ｅ
Ｇ０６Ｆ　3/033	３６０	Ｇ０６Ｆ　3/033	３６０Ｈ
Ｈ０１Ｈ　11/00		Ｈ０１Ｈ　11/00	Ｂ
// Ｃ０８Ｇ　77/04		Ｃ０８Ｇ　77/04	
77/54		77/54	

審査請求　未請求　請求項の数３　ＦＤ　（全 11 頁）

(21)出願番号　特願平10－64752

(22)出願日　平成10年(1998)２月27日

(71)出願人　000001339
グンゼ株式会社
京都府綾部市青野町膳所１番地

(72)発明者　野田　和裕
滋賀県守山市森川原町163番地　グンゼ株式会社滋賀研究所内

(72)発明者　佐藤　博十志
滋賀県守山市森川原町163番地　グンゼ株式会社滋賀研究所内

(72)発明者　村上　雪雄
滋賀県守山市森川原町163番地　グンゼ株式会社電子機能材料センター内

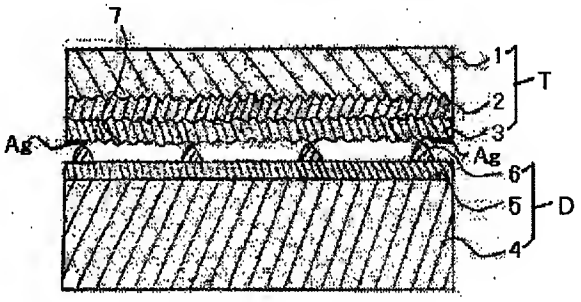
最終頁に続く

(54)【発明の名称】　抵抗膜型透明タッチパネル

(57)【要約】

【課題】　本発明は、より高い透明性と視認性及び耐摩耗性をもって、更にニュートンリングの発生しない抵抗膜型透明タッチパネルを提供する。

【解決手段】　膜厚２０～５５ｎｍの酸化ケイ素薄膜層（２）を中間層として介在するタッチ側透明電極（Ｔ）とディスプレイ側透明電極（Ｄ）とが、絶縁スペーサ（６）を介して対向配置してなる抵抗膜型透明タッチパネルにおいて、該タッチ側又は／及びディスプレイ側の上面に積層されているＩＴＯ等による透明薄膜電極（３、５）の表面が、Ｒａ＝０．０５～２μｍ、Ｒｍａｘ＝０．６～２．５μｍの無数の微細凹凸による粗面（７）を有している。



1

【特許請求の範囲】

【請求項１】　透明樹脂フィルム（１）の片面に、膜厚２０～５５ｎｍの酸化ケイ素薄膜層（２）と透明薄膜電極層（３）とが順次積層されているタッチ側透明電極（Ｔ）と、透明板（４）の片面に透明薄膜電極層（５）が積層されているディスプレイ側透明電極（Ｄ）とが、その透明薄膜電極層（３、５）を対向して、絶縁スペーサ（６）を介して配置されてなる抵抗膜型透明タッチパネルにおいて、タッチ側又は／及びディスプレイ側の透明薄膜電極層（３、５）の表面が、中心線平均粗さ（Ｒａ）０．０５～２μｍ、その最大高さ（Ｒｍａｘ）０．６～２．５μｍの無数の微細凹凸による粗面（７）を有することを特徴とする抵抗膜型透明タッチパネル。

【請求項２】　前記酸化ケイ素薄膜層（２）がペルヒドロポリシラザンの分解又は多官能アルコキシシランのゾルーゲル法によるコーティング層からなる請求項１に記載の抵抗膜型透明タッチパネル。

【請求項３】　前記透明板（４）が環状ポリオレフィンとポリカーボネート板又はガラス板との複合透明板である請求項１又は２に記載の抵抗膜型透明タッチパネル。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、高い透明性と視認性を維持し、より高い耐摩耗性（ペン摺動に対する）と共に、ニュートンリングの発生しない高度に改良された抵抗膜型透明タッチパネルに関する。

【０００２】

【従来の技術】一般に抵抗膜型透明タッチパネル（以下、単にタッチパネルと呼ぶ。）は、ディスプレイ側にＩＴＯ（Indium Tin Oxide）等の透明電極を設けたガラス板を、そして、タッチ側には同様に薄膜透明電極を設けたフレキシブルな透明樹脂フィルム（例えば、ポリエチレンテレフタレートフィルム）を用いて、該電極面を絶縁スペーサを介して対向配置して作られた一つのフラットパネルデバイスであり、これは液晶ディスプレイ、ＣＲＴディスプレイ等と組み合わされて使用されている。

【０００３】ところで、タッチパネルの用途拡大と共に、品質、性能面における要求も厳しくなり、特に透明性、視認性、耐摩耗性の一層の改良が求められるようになった。そこで、本発明者らは、先に、これらの課題を解決するための新たな手段を見出し、例えば特開平８－６４０６７号公報又は特開平９－２３７１５９号公報で公開されている。

【０００４】前記各号公報は、従来のタッチパネルを構成するタッチ側又はディスプレイ側のＩＴＯ等による薄膜透明電極に関し、膜厚を特定した酸化ケイ素層を中間介在せしめることによって達成しようとするものである。つまり、特開平８－６４０６７号公報では、透明フィルム上に、まず１００～６００Åの酸化ケイ素薄膜層を設け、その上にＩＴＯ薄膜層を設けるものであり、一方、特開平９－２３７１５９号公報は、前記特開平８－６４０６７号公報の更なる改良として、特にペルヒドロポリシラザンの化学的分解により形成される膜厚２０～５５ｎｍの二酸化ケイ素コーティング薄膜層を設け、その上にＩＴＯ等の薄膜層を設けるものである。

2

【０００５】

【発明が解決しようとする課題】ところが最近新たに、光干渉によって生じるニュートンリングに関する問題が提起され、早急に解決する必要が生じた。このニュートンリングは、タッチパネルのタッチ側をペン又は指でタッチして情報入力を行う際に、そのタッチ点を中心に虹色の縞模様がリング状に発生する現象である。

【０００６】更に、このニュートンリングはタッチパネル自体のサイズが大きくなるほど発生しやすくり、これが発生すると視認性が極めて悪くなる。視認性とは、画面が見やすく気持ちよく（いらつかないで）入力動作できる性能をいうが、入力動作の度にニュートンリングが発生すると、常に目に入るため気持ちよく入力動作ができなくなる。更に、このタッチパネルが液晶ディスプレイと組み合わせて使用されると、該ディスプレイからのカラー画像とニュートンリングによる虹模様とがオーバーラップし、更に視認性を悪くすることにもなる。また特に連続的に速く入力動作を行う場合に、ニュートンリングが残存していると、次に入力動作が遅くなるとか誤入力してしまうという問題も発生することになる。つまり、タッチパネルにおけるニュートンリングの問題も、他の必要な特性向上と共に、極めて重要な解決課題である。

【０００７】本発明は、より改良された透明性と視認性、更には耐摩耗性の上に立って、これにニュートンリングが発生しない特性を付与したタッチパネルを開発することを課題とし、鋭意検討した結果、その解決手段を見出し達成したものである。それは次のような手段を講ずるものである。

【０００８】

【課題を解決するための手段】即ち本発明は、請求項１に記載して明らかにするように、透明樹脂フィルム（１）の片面に、膜厚２０～５５ｎｍの酸化ケイ素薄膜層（２）と透明薄膜電極層（３）とが順次積層されているタッチ側透明電極（Ｔ）と、透明板（４）の片面に透明薄膜電極層（５）が積層されているディスプレイ側透明電極（Ｄ）とが、その透明薄膜電極層（３、５）を対向して、絶縁スペーサ（６）を介して配置されてなる抵抗膜型タッチパネルにおいて、タッチ側又は／及びディスプレイ側の透明薄膜電極層（３、５）の表面が、中心線平均粗さ（Ｒａ）０．０５～２μｍ、その最大高さ（Ｒｍａｘ）０．６～２．５μｍの無数の微細凹凸による粗面（７）を有することを特徴とする抵抗膜型透明タッチパネルである。そして請求項２～３では、請求項１

に従属するものとして好ましい形態での発明として提供するものである。以下に本発明を詳述する。

【０００９】

【発明の実施の形態】まず、本発明の前提となるタッチパネル（抵抗膜型透明タッチパネル）について説明する。図１に示したように、該タッチパネルにおけるタッチ側透明電極（Ｔ）の構成基体である透明樹脂フィルム（１）としては、一般には厚さ約０．１～０．２mm、全光線透過率（以下、Ｔｔと略す）が約８０％以上あって、更に耐熱性、耐屈曲性、耐溶剤特性等にも優れていて、柔軟的で回復弾性に富むフィルム状物が使われる。具体的には二軸延伸された透明なポリエチレンテレフタレートフィルム（以下、ＰＥＴフィルムと呼ぶ）をはじめ、他に、例えば、ポリエチレンナフタレートフィルム、ポリエーテルスルホンフィルム、ポリカーボネートフィルム、ポリアリレートフィルム、ポリスルホンフィルム、非晶性ポリエステルフィルム、非晶性ポリオレフィンフィルム等を挙げることができる。

【００１０】そして、前記透明樹脂フィルムの片面に、まず膜厚２０～５５nm、好ましくは３０～５０nmの酸化ケイ素薄膜層（２）を設ける。限定された該薄膜層が形成されていることで、ＩＴＯ等による透明薄膜電極層のみの場合に比較して全体としてのＴｔがより向上すると共に、タッチ入力動作によって直接タッチする該電極層の耐摩耗性（長期間の使用でも該電極層が摩耗するとかクラックの発生がないこと）において極めて優れた状態となる。更に、本発明における前記透明薄膜電極層表面が粗面状態にあっては前記特性が失われることなく、より向上することとなる。つまり、膜厚２０～５５nmの酸化ケイ素層と、後述する該電極層表面に設けられている前記特定範囲にある無数の微細凹凸にある粗面（７）とは、不可避的に結合されていることになる。具体的には、該電極層表面の該特定範囲にある粗面であっても、２０nm未満では特に透明性が悪く耐摩耗性にも劣り、そして５５nmを越えるとクラックが発生し易くなり摩耗性が悪くなるばかりか、淡黄色の色感を発現し人間の目に対し好ましくない状況となる。

【００１１】前記酸化ケイ素薄膜層（２）の形成手段は、特に限定されないが、一般にはスパッタリング法、真空蒸着法、ＣＶＤ法等の薄膜形成手段とペルヒドロポリシラザン又は多官能アルコキシシランを原料とし、これらのコーティングによって形成するコーティング法とを例示することができる。

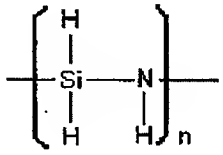
【００１２】例えば、前記スパッタリング法では、まず、一般的に好ましく行われる前記ＰＥＴフィルムなどの透明樹脂フィルムの片面を脱脂洗浄とかコロナ、グロー等による放電を前処理として行った後、ターゲットとして二酸化ケイ素や導電性不純物を添加したケイ素と該フィルムをスパッタリング装置の真空槽内に対峙してセットする。そしてアルゴン等の不活性ガス又は該ガスに酸素を混合し該槽内に導入することで、該槽内の真空度を１０-1～１０-3Ｔｏｒｒ程度に保つ。そして高周波又は直流マグネトロン方式によってスパッタ蒸着して、２０～５５nmの薄膜を形成する方法である。

【００１３】一方、コーティング法として例示するペルヒドロポリシラザンによる酸化ケイ素薄膜層は、まず前記透明樹脂フィルムの片面に、該ポリシラザンの有機溶媒溶液（例えばキシレン、デカヒドロナフタレン等の芳香族化合物とかジブチルエーテル等の脂肪族エーテル等を溶媒として固形分濃度を数%にした溶液）を、スピンコーティング、ディップコーティング、スプレーコーティング、ロールコーティング等の方法によってコーティングする。次にこのコーティングされた該ポリシラザン面を脂肪族アミン（例えばトリエチルアミン）を蒸気化し、これと水蒸気とを混合した混合蒸気雰囲気下に放置する。最後に１００℃前後、相対湿度８０％前後の高温高湿雰囲気下に数分間放置すると、該ポリシラザンは化学的に分解して二酸化ケイ素に変化し、２０～５５nmの膜厚で形成される。この該ポリシラザンの二酸化ケイ素への分解手段には、他に、例えばナトリウムアルコラート、アセチルアセトナート錯体（例えばパラジウム錯体）を分解促進剤として添加し湿気中で加熱することでも可能であるので、その方法には特に限定されない。

【００１４】尚、前記ポリシラザンは、例えば東燃株式会社から低温硬化型ポリシラザン溶液（例えばＮ－Ｖ１１０）として上市されている。この化学構造は基本的には下記化１（ｎは重合度）で示されるが、下記化２に示す不規則な環状構造のものが共存することもある。

【００１５】

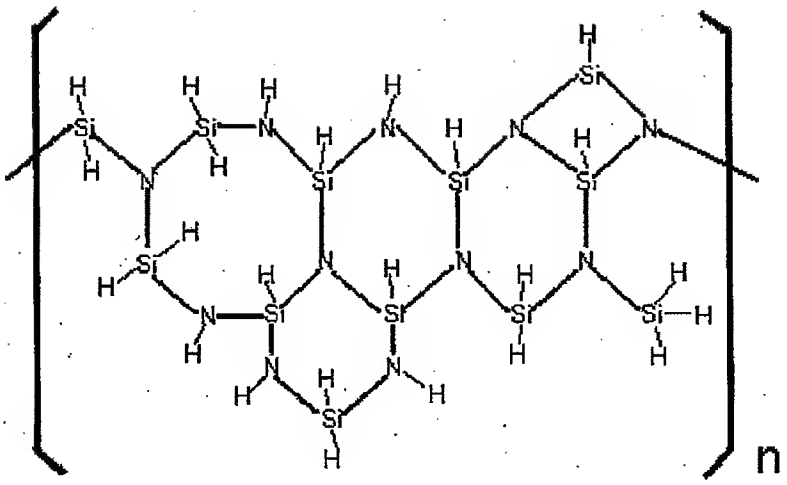
【化１】



【００１６】

【化２】

5　　6



【００１７】前記ポリシラザンの分子量は、あまりに高分子量であると有機溶媒に対する溶解性が低下することと、二酸化珪素への反応活性も低下するので望ましくない。望ましい分子量は、約６００～２，０００であり、オリゴマと呼ばれる程度のポリマであるのが好ましい。尚、化１又は化２において、水素原子が、例えば、アルキル基によって置換されたポリオルガノシラザンの若干の共存は許されるにしても、実質的には除外される。これは、より均質な二酸化珪素コーテング層形成にとって有効でないからである。また、該ポリシラザンは、例えば、ジクロロシランとピリジンとの錯体にアンモニアを注入し、アンモノリシスを行うことで合成できる。

【００１８】次に、多官能アルコキシシランによるゾルーゲル法によるコーティングについて説明する。まず、該アルコキシシランはアルコキシ基の２～４個を結合するシラン化合物で、具体的に例えばジメトキシジメチルシラン、トリメトキシメチルシラン、テトラメトキシシラン、ジエトキシジエチルシラン、トリメトキシエチルシラン、テトラエトキシシラン等が挙げられる。中でもアルコキシ基を３～４個結合するアルコキシシランが二酸化ケイ素への変化を効率的に行うことができるので好ましい。

【００１９】そして前記多官能アルコキシシランを水とアルコール類と触媒（塩酸など）の混合液に混合する。各成分の混合比は予備実験により最適値を求めて決められるが、一例を挙げれば、該アルコキシシラン１モルに対して水２モル、アルコール類（主としてエチルアルコール）６モル、塩酸０．０３モルの割合である。得られたゾルーゲル液は、前記したペルヒドロポリシラザンに例示するコーティング方法によって透明樹脂フィルムにコーティングする。コーティングが終了したら、常温で放置し、予め溶媒を蒸発除去して、最後に所定温度（一般に１００℃前後）で加熱する。コーティングされている該アルコキシシラン層は分解して二酸化ケイ素に変化する。尚、前記ゾルーゲル液は、例えばコルコート株式会社からコルコートＮ－１０３Ｘとして上市されている。

【００２０】以上、膜厚２０～５５ｎｍの酸化ケイ素薄膜層の形成手段について例示したが、中でも後者二つのコーティング法による形成が好ましい。これは、スパッタリングなどの薄膜形成手段では、淡い黄色に着色しやすく、視認性の低下につながることと、後述する微細凹凸による粗面化において、中心線平均粗さとその最大高さとが所望する通りに得られにくく、コントロールしにくい。一方、後者二方法においては、完全に無色透明であり視認しやすく、該粗面化において中心線平均粗さとその最大高さとが所望する通りに得られ、コントロールしやすいことによるものである。

【００２１】尚、前記色感が異なることについては、形成させされる酸化ケイ素の二酸化ケイ素からの化学量論的ずれに起因するものと考えられる。つまりスパッタリング等の薄膜形成法では、形成される酸化ケイ素がＳｉＯｘ（ｘ＝１～１．９）で示されるもので、ＳｉＯやＳｉ2O3なども共存している状態である。これらの共存により、二酸化ケイ素よりも屈折率が高くなるとともに可視光領域での光吸収が生じる。しかし、ペルヒドロポリシラザンや多官能アルコキシシランのコーティングからなる酸化ケイ素層は純粋な二酸化ケイ素に近くなっているため、屈折率も小さく光吸収も生じない。

【００２２】前記酸化ケイ素層は、タッチ側透明樹脂フィルムには必須とするが、ディスプレイ側の透明板（４）にも前記同様形成してもよい。もちろん、これら各基板の両サイドに同様設けることには制限はない。

【００２３】次に、タッチ側では膜厚２０～５５ｎｍの酸化ケイ素層の上に、ディスプレイ側では透明板（４）の片面に積層する透明薄膜電極層（３、５）について説